Transportation

This guidance is intended to clarify how the Transportation Goal and Objectives of the Regional Policy Plan (RPP) are to be applied and interpreted in Cape Cod Commission Development of Regional Impact (DRI) project review. This technical bulletin presents specific methods by which a project can meet these goals and objectives.

Transportation Goal: To provide and promote a safe, reliable, and multi-modal transportation system.

- ***Objective TR1*** *– Improve safety and eliminate hazards for all users of Cape Cod's transportation system.*
- ***Objective TR2*** *– Provide and promote a balanced and efficient transportation system that includes healthy transportation options and appropriate connections for all users.*
- ***Objective TR3*** *– Provide an efficient and reliable transportation system that will serve the current and future needs of the region and its people.*

The applicability and materiality of these goals and objectives to a project will be determined on a case-by-case basis considering a number of factors including the location, context (as defined by the Placetype of the location), scale, use, and other characteristics of a project.

THE ROLE OF CAPE COD PLACETYPES

The RPP incorporates *a framework for regional land use policies and regulations based on local form and context* as identified through categories of Placetypes found and desired on Cape Cod.

The Placetypes are determined in two ways: some are depicted on a map contained within the RPP Data Viewer located at www.capecodcommission.org/RPPDataViewer adopted by the Commission as part of the Technical Guidance for review of DRIs, which may be amended from time to time as land use patterns and regional land use priorities change, and the remainder are determined using the character descriptions set forth in Section 8 of the RPP and the Technical Guidance.

The project context, as defined by the Placetype of the location, provides the lens through which the Commission will review the project under the RPP. Additional detail can be found in the Cape Cod Placetypes section of the Technical Guidance.

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NOTE ON APPLICATION MATERIALS, DEFINITIONS, RESOURCES AND REFERENCES

Application materials, generally presented in the form of a Transportation Impact Assessment (TIA), should provide sufficient detail to demonstrate that the project meets the applicable goals and objectives, but typically include a:

A. Project description
B. Trip generation analysis
C. Detailed multi-modal site plan
D. Driveway safety analysis
E. Off-site safety analysis*
F. Trip reduction analysis*
G. Off-site congestion analysis**

*Required for Study Area locations where the project is expected to increase traffic by 25 or more trips during the project's peak hour.

**Required if credits for trip reduction measures are proposed.

See TIA guidance on page TR-22 for further guidance.
A list of references and resources are provided on page TR-31

INTRODUCTION

Numerous subsystems make up Cape Cod's transportation network including vehicular roadways, railways, public transportation, air travel, marine transportation, and pedestrian and bicyclist accommodations and networks. These systems are responsible for safely and effectively moving the people of the region and the goods they rely on. Additionally, these systems must serve not only the year-round population but must also effectively handle the movements of the more than doubled seasonal population, which requires building and maintaining a transportation system that functions under the strain of the peak season, without negatively impacting the character that defines this unique place.

Section 7 of the RPP – Coordinated Regional and Local Planning – outlines the vision of the Cape Cod Regional Transportation Plan (RTP) and identifies the important connection between transportation and land use planning. If the region is to achieve the RTP vision for "a transportation system that supports the environmental and economic vitality of the region through infrastructure investment that focuses on livability, sustainability, equity, and preservation of the character that makes our special place special," smart transportation investment and land use planning decisions need to be made at all levels.

This Technical Guidance provides examples of various methods and strategies that DRI projects may use to satisfy the Transportation Goal and Objectives of the RPP. Through implementation of these methods and strategies, DRI projects can support the advancement of a transportation system consistent with the vision of the region.

SUMMARY OF METHODS

GOAL | TRANSPORTATION

To provide and promote a safe, reliable, and multi-modal transportation system.

OBJECTIVE TR1 – Improve safety and eliminate hazards for all users of Cape Cod's transportation system

METHODS

All DRIs must employ the following methods to meet Objective TR1:

- Prepare an appropriate Transportation Impact Assessment (TIA). (see page TR-22)
- Apply good access management principles in site and driveway design. (see page TR-9)
- Locate driveways to provide acceptable sight distance and locate signs, vegetation, lighting, and other fixed objects in manner that avoid creating sight distance obstructions. (see page TR-10)
- Provide safe pedestrian connections throughout the site and, where practical, to adjacent sites. (see page TR-10 and page TR-13)
- For projects anticipated to generate 50 or more peak hour trips, present a detailed analysis of off-site safety impacts of the development at Study Area locations (defined on page TR-23) and implement appropriate safety improvements. (see page TR-11)

OBJECTIVE TR2 – Provide and promote a balanced and efficient transportation system that includes healthy transportation options and appropriate connections for all users

METHODS

All DRIs must employ the following methods to meet Objective TR2:

- Housing and employment sites should implement Transportation Demand Management (TDM) best practices. (see page TR-14)
- For employment sites, with 25 or more employees, develop and implement a site-specific TDM Plan. (see page TR-14)

Where feasible:

- Provide appropriate rights-of-way along the street frontage and/or across the property to accommodate current and future pedestrian, bicycle, and transit needs.

Where feasible and appropriate:

- Construct sidewalks, multi-use paths, and/or bicycle/pedestrian connections along or across the site with connections out to the existing pedestrian and bicycling network (see criteria on page TR-14).

OBJECTIVE TR2 AREAS OF EMPHASIS BY PLACETYPE

Natural Areas and Rural Development Areas | Implement TDM. Preserve the natural, scenic, and cultural resources. Improvements should be recommended where they enhance protection of, improve non-vehicular access to, and do not adversely impact these resources

Suburban Development Areas | Implement TDM. Address gaps in the pedestrian network while reinforcing the desirable character elements of the area.

Historic Areas and Maritime Areas | Implement TDM. Reinforce the desirable character elements of the area while addressing gaps in the pedestrian network.

Community Activity Centers | Implement TDM. Address gaps in the pedestrian network while reinforcing the desirable character elements of the area.

Industrial Activity Centers and Military and Transportation Areas | Implement TDM. Minimize conflicts between motorists and non-motorists.

OBJECTIVE TR3 – Provide an efficient and reliable transportation system that will serve the current and future needs of the region and its people

METHODS

All DRIs must employ the following methods to meet Objective TR3:

- Provide for full mitigation of congestion impacts on the transportation system through a combination of trip reduction measures, physical congestion mitigation, and, as appropriate, congestion mitigation payments commensurate with the development's congestion impact. (see page TR-16)
- For projects anticipated to generate 100 or more peak hour trips, provide a detailed analysis of off-site congestion impacts and of any proposed physical congestion mitigation. (see page TR-16)

OBJECTIVE TR3 AREAS OF EMPHASIS BY PLACETYPE

Natural Areas and Rural Development Areas | Implement trip reduction measures and mitigate remaining congestion impacts through congestion mitigation payments. Physical improvements may be appropriate where they enhance compatible access to natural, scenic, and cultural resources and do not adversely impact these resources.

Suburban Development Areas | Address congestion impacts within the study area through compatible physical improvements. Impacts beyond the study area may be mitigated through congestion mitigation payments.

Historic Areas and Maritime Areas | Implement trip reduction measures and mitigate remaining congestion impacts through congestion mitigation payments. Physical improvements may be appropriate where they enhance compatible access to natural, scenic, and cultural resources and do not adversely impact these resources.

Community Activity Centers, Industrial Activity Centers, and Military and Transportation Areas | Address congestion impacts within the study area through physical improvements. Impacts beyond the study area may be mitigated through congestion mitigation payments.

DETAILED DISCUSSION OF METHODS FOR MEETING OBJECTIVE TR1

Objective TR1 *– To improve safety and eliminate hazards for all users of Cape Cod's transportation system*

Detail on the methods for meeting Objective TR1 is provided below.

Access Management

Access management is the coordinated planning, regulation, and design of access between roadways and land development. It involves the systematic control of the location, spacing, design, and operation of driveways, median openings, interchanges, and street connections to a roadway, as well as roadway design applications that affect access, such as median treatments and auxiliary lanes, and the appropriate separation of traffic signals. (Transportation Research Board. *Access Management Manual*.) Good access management principles balance land access and traffic mobility needs based on the type of roadway, specifically the functional classification of the roadway.

The design and location of driveways directly affects traffic operations on the mainline roadway. The spacing of adjacent and opposing driveways, and the spacing of driveways relative to road intersections, influences crash potential.

Good access management principles should be applied to the greatest extent feasible given site constraints. Where feasible, this would include:

- Prohibiting turn-movements that present a hazard through physical means (ex. median installation, channelizing islands in the driveway);
- Limiting the total number of driveways;
- Sharing access with existing driveways instead of creating a new driveway;
- Limiting access and egress to the lower volume roadway when the site has frontage on more than one roadway; and
- Allowing for and, where feasible, constructing interconnections with adjacent properties.

The applicant should seek early coordination with Cape Cod Commission staff to ensure that good access management practices are being followed in the proposed project.

Driveway Location and Design

The location and design of site driveways impact the safety of those accessing the site as well as of users of the adjacent transportation network.

The site driveway should be located to avoid the creation or intensification of a hazard. Acceptable sight distance, as defined by the latest edition of the *American Association of State Highway and Transportation Officials (AASHTO) A Policy on Geometric Design of Highways and Streets*, should be met and maintained at all driveways. Furthermore, human-made sight-distance obstructions such as signage, utility poles and boxes, vegetation, and lighting must be located to avoid visual obstructions as to not negatively impact motorist or non-motorist safety.

Excessively wide curb cuts present a hazard to pedestrians by extending the pedestrian crossing distance thereby increasing exposure. Excessive driveway corner radii also present a hazard to pedestrians by allowing for higher vehicle turning speeds. Driveway width and driveway corner radii should be no larger than needed to accommodate vehicles anticipated to use the site. The *National Association of City Transportation Officials (NACTO) Urban Streets Design Guide* presents a discussion of appropriate corner radii for a variety of conditions.

Driveway travel lanes should not exceed 11 feet per travel lane unless required by local or state design standards. Driveways with a throat width exceeding 22 feet should include a center pedestrian refuge island, where appropriate.

Site Design

Good site design accommodates all roadway users including pedestrians, bicyclists, and motorists in a safe manner. Conflicts between motorists and non-motorists should be minimized and, where possible, eliminated, through the provision of appropriate sidewalks, crosswalks, curb ramps, and bicycle accommodation. Safe pedestrian connections should be provided throughout the site.

Pedestrian and bicyclist facilities should be safe, convenient, and attractive to encourage frequent use. Federal and state law require that all facilities that allow for

use by the public must be compliant with all applicable Americans with Disabilities Act (ADA) and Massachusetts Architectural Access Board (AAB) requirements. Amenities such as bicycle racks, benches, and bus shelters should be incorporated where appropriate.

A more detailed discussion of site design can be found within the Community Design section of the RPP Technical Bulletin.

Off-Site Safety Impacts and Mitigation

A project may impact transportation safety beyond the site driveway. Regardless of the size or nature of the development, developments should not degrade safety for pedestrians, bicyclists, or motor vehicle operators or passengers.

The applicant should identify safety impacts of the development and implement appropriate safety improvements at all Study Area locations. Study Area locations should include, at a minimum, all regional road links, all intersections of regional roads, and all local road intersections with regional roads that are used by a project for access to the regional road network, where the project is expected to increase traffic by 25 or more trips during the project's peak hour. Additional Study Area locations, identified in consultation with Cape Cod Commission staff, town officials, and, as appropriate, the Massachusetts Department of Transportation (MassDOT), may be required.

A Study Area location is considered a high crash location if, over the most recent five (5) years on record, the location averaged of three (3) or more crashes per year or exhibited a crash rate higher than regional average crash rate. The regional average crash rate should be based on Massachusetts Department of Transportation District 5 average crash rates for signalized intersections, unsignalized intersections, and roadway segments (by functional classification).

To allow the Commission to consider potential safety impacts and appropriate safety mitigation, the Applicant must provide:

- A table and map with number of crashes occurring at each Study Area location (roadway segment and intersection) over the most recent five (5) years on record with the Massachusetts Department of Transportation Registry of Motor Vehicles.

- A collision diagram and crash data summary table for each high crash locations based on crash reports obtained from the local police department and, as appropriate, the Massachusetts State Police.
- Crash analysis for all high crash locations identifying potential safety issues at each location and any potential safety impacts attributable to the proposed project.
- A summary of proposed safety mitigation.

Overall, this analysis must demonstrate that, with the proposed safety mitigation, the development will not degrade safety for pedestrians, bicyclists, or motor vehicle operators or passengers.

DETAILED DISCUSSION OF METHODS FOR MEETING OBJECTIVE TR2

Objective TR2 *– Provide and promote a balanced and efficient transportation system that includes healthy transportation options and appropriate connections for all users*

Detail on the methods for meeting Objective TR2 is provided below.

Healthy Transportation Approach

Supporting healthy transportation options involves decisions about the site and amenities on the site that support the individuals who wish to use healthy transportation modes to access the site.

To the extent feasible, the following site design features and amenities should be included in all projects:

- Sidewalk connections to all buildings
- Safe crossing treatments at all driveway and parking lot crossings
- Conveniently located bicycle racks

Supporting healthy transportation options also involves supporting and providing connections to the region's pedestrian, bicycle, and transit networks.

The region's sidewalk network on Cape Cod has been built out over time. Further development of this network will require a cooperative, coordinated approach with both public and private partners.

In support of further development of the region's sidewalk network, the applicant should provide appropriate rights-of-way along the street frontage and/or across the site to accommodate expected needs for pedestrian, bicycle, and transit accommodation.

Furthermore, where deemed appropriate by the Commission, the applicant should construct sidewalks, multi-use paths, and/or bicycle/pedestrian connections along or across the site.

Where gaps between on-site pedestrian accommodations and the region's sidewalk network exist, extending sidewalks beyond the site may be required to ensure safe

pedestrian access. In determining whether to require construction of sidewalks, multi-use paths and/or bicycle/pedestrian connections along or across the site with connections out to the existing pedestrian and bicycling network, the Cape Cod Commission will consider the extent to which the improvement is necessary to meet Objective TR2 and consider the following factors:

- The location of the project;
- The nature and scale of the project;
- Any constraints to project implementation;
- The anticipated cost of the potential improvement; and
- The anticipated benefit of the potential improvement.

Transportation Demand Management (TDM): Best Practices

Transportation Demand Management (TDM) is a combination of strategies employed to reduce single-occupancy vehicle trips to and from a site. The effectiveness of any strategy, or combination of strategies, depends on the type of land use proposed, proximity to existing transit corridors, walking and bicycling characteristics of the area, and other factors. In all cases, applicants are encouraged to identify and evaluate strategies that are appropriate for the project. Sources of data should be identified, and methods used should be justified.

Sites with fewer than 25 employees or sites that include residential units may consider adopting industry standard TDM Best Practices rather than developing a site-specific TDM plan. Cape Cod Commission staff and MassRIDES staff can provide these TDM best practices. Typical TDM Best Practice measures include:

- Posting of carpool brochures on-site and online
- Posting of transit schedules on-site and online
- Carpool parking spaces
- Bicycle storage
- On-site services such as an employee lunch room
- Enroll in the MassRIDES employer program

Site-Specific TDM Plans

Projects with more than 25 employees are strongly encouraged to develop a site-specific TDM plan. This TDM plan would build on the TDM Best Practices with additional strategies appropriate for larger employers such as:

- On-site Transportation coordinator
- Trip reduction monitoring program
- Showers and changing facilities for pedestrian and bicyclists
- Arrange employee work hours to match transit schedules
- Compressed work weeks
- Flexible work hours for ridesharers
- Delivery services
- Provide/subsidize vans for vanpoolers
- "Guaranteed ride home" program (company car, rental car, cab, designated driver)
- Subsidize transit passes
- Incentives and allowances for using modes of transportation other than a single-occupancy vehicle

Cape Cod Commission staff and MassRIDES staff are available as resources when considering elements of an appropriate TDM plan.

More information on MassRIDES is available at https://commute.com/.

DETAILED DISCUSSION OF METHODS FOR MEETING OBJECTIVE TR3

Objective TR3 *– Provide an efficient and reliable transportation system that will serve the current and future needs of the region and its people*

Detail on the methods for meeting Objective TR3 is provided below.

Congestion Mitigation Approaches

DRIs are required to provide for full mitigation of congestion impacts on the transportation system through a combination of trip reduction measures, physical congestion mitigation, and, as appropriate, congestion mitigation payments commensurate with the development's congestion impact. The Cape Cod Commission will consider the following factors in determining if the congestion mitigation approach proposed for a DRI meets Objective TR3:

- The location of the project;
- The nature and scale of the congestion impacts of the project;
- The anticipated effectiveness of any trip reduction measures that are being proposed;
- The anticipated cost and congestion benefit of any physical off-site improvements that are being proposed; and
- Whether a congestion mitigation payment can be effectively utilized to offset the anticipated congestion impacts of the project.

Congestion Mitigation through Trip Reduction Measures

Reducing the number of vehicle trips to and from the site reduces the congestion impacts of the project. This can be achieved through means such as, appropriate siting of developments, providing a mix of uses on the site, the promotion of healthy transportation options, and the implementation of Transportation Demand Management measures. The anticipated success of these trip reduction measures should be based on standard industry practice and any sources should be clearly cited.

Net congestion impacts can be further reduced by the donation and protection, through a development restriction pursuant to MGL, Chapter 184, of land in excess of open space mitigation otherwise required by the RPP. Where credit for the donation

and protection of land is proposed by the Applicant and deemed appropriate by the Commission, at a minimum, the land proposed for credit must:

- Be permanently protected through fee simple donation to a conservation entity such as a town conservation commission or an appropriate non-profit land trust, or through the grant and imposition of a development restriction pursuant to MGL, Chapter 184. The method of protection must extinguish future development potential on the land proposed for credit;
    - For developed land:
        - The trip reduction credit should be based on traffic counts at the existing site, ITE trip generation data for the existing land use, or, at the discretion of Cape Cod Commission staff, ITE trip generation data for the same land use and trip generation values/formulas as the proposed DRI project.
    - For vacant land:
        - The land must include the entirety of individual, buildable lot(s);
        - The land must be buildable, having the minimum lot area and minimum (actual and legal) lot frontage required under local zoning and subdivision law;
        - The land should meet the zoning requirements in effect including allowed use and bulk/dimensional requirements such as minimum yard setbacks, maximum building/lot coverage, and maximum building height;
        - The trip reduction credit should be based on trip generation data for the same land use and trip generation values/formulas as the proposed DRI project; and,
        - A preliminary sketch of the potential site development on the credit land, supporting the credit requested, shall be included with the DRI application materials.

Physical Congestion Mitigation

Where physical congestion mitigation is proposed by the Applicant and deemed appropriate by the Commission, it should be designed to accommodate the Estimated Annual 30th Highest Hour Volume during Build Conditions with appropriate Level of Service (LOS). Cape Cod Commission staff should be consulted to determine the appropriate adjustment factors to calculate the Estimated Annual 30th Highest Hour

Volume for the location(s) proposed to be improved. Physical congestion mitigation must:

- Safely accommodate all road users;
- Result in a Build Condition operation that must be no worse than the No-Build Condition operation (as measured by LOS, delay, and queue length);
- Be in accordance with the access requirements, standards, and policies of the applicable state, regional, and/or local jurisdiction; and
- Not degrade historic resources, historic character, community character, scenic resources, and/or natural resources.

Where physical improvements enhance access to natural, scenic, and cultural resources it should be compatible to these resources. The improvement should not significantly change a roadway layout in a way that detracts from its character. Furthermore, the physical improvement should not increase the access or roadway capacity to a level that the resource cannot reasonably accommodate. Improvements that are considered compatible access may increase the ability of the public to access natural, scenic, and cultural resources through lower impact approaches such as transit or remote parking where appropriate and not in excess.

If a new signal is proposed, a roundabout feasibility analysis should also be evaluated. The most appropriate form of traffic control should be implemented.

The cost for improvements that benefit only vehicles accessing the proposed project site should not be considered congestion mitigation. Examples include acceleration and deceleration lanes for new site access points, new left turn lanes which only provide access to the site, and new traffic signals located at the applicant's driveway(s). Where benefits of the improvement are utilized by vehicles accessing the proposed project site and other roadways users, a fair share proportion of the improvements benefiting other roadway users may be included as congestion mitigation.

The total cost of proposed physical mitigation should be clearly set out in the DRI application material.

Fair Share Congestion Mitigation Payment

At the discretion of the Commission, an Applicant may mitigate congestion impacts at specific Study Area locations using a Fair Share Payment as a substitute for physical mitigation.

FAIR SHARE PAYMENT CALCULATIONS

Where a Fair Share Congestion Mitigation Payment is proposed by the Applicant and deemed appropriate by the Commission for a Study Area location, it must be calculated based on the estimated costs of a capacity increase in traffic generation apportioned to and occasioned by the project as follows:

1. Determine the *Capacity With Mitigation* and the *Capacity Without Mitigation.* In this context, capacity is defined as the maximum traffic volume possible with LOS E. When more than one measure of LOS is possible at a location, such as the various movements at an unsignalized intersection, then the most sensitive measure, i.e., any one movement operating at LOS E/F, is the movement used to determine the capacity. Traffic volumes for all movements should be factored by a constant so that all movements will remain a fixed percentage of the total volume at the location. The sum of the volumes of all movements is the Capacity for that scenario. *Capacity Without Mitigation* will be that of the given Location's existing geometric configuration under prevailing traffic conditions (such as peak hour factor, vehicle mix, and other assumptions consistent with the pattern of existing traffic and projected traffic growth) combined with DRI traffic (and then factored to meet the LOS E maximum volumes). *Capacity With Mitigation* will be that of the given Location's proposed (mitigated) configuration under prevailing traffic conditions, given the pattern of existing traffic and projected traffic growth combined with DRI traffic (and then factored to meet the LOS E maximum volumes).
2. Calculate the *Capacity Addition* by subtracting *Capacity Without Mitigation* from the *Capacity With Mitigation***,** as reflected in the following formula:

   Capacity Addition = Capacity With Mitigation - Capacity Without Mitigation

3. Calculate the *Fair Share Proportion* as the *DRI Traffic* divided by the *Capacity Addition,* as reflected in the following formula:

   Fair Share Proportion = DRI Traffic / Capacity Addition

4. Calculate *Mitigation Cost* to public agency(ies) that would be implementing transportation improvement. This cost should be based on costs of similar projects

constructed within the MassDOT District 5 or from current estimated unit costs provided by MassDOT.

5. Calculate the *Fair Share* as the *Fair Share Proportion* times the *Mitigation Cost*, as reflected in the following formula:

$$Fair\ Share = Fair\ Share\ Proportion \times Mitigation\ Cost$$

6. Calculate the *Fair Share Contribution* at each location as the *Fair Share* at each location less the estimated value of Physical Mitigation performed at the expense of the Applicant. The Fair Share Contribution should likewise be reduced by the amount, if any, which is assessed in other agencies' transportation impact fees and the transportation portion of municipalities' local impact fees which are directly related to the specific location.

$$Fair\ Share\ Contribution = Fair\ Share - (Value\ of\ Physical\ Mitigation + Transportation\ Impact\ Fees\ assessed\ by\ other\ agencies)$$

The total *Fair Share Congestion Mitigation Payment* is equal to the sum of the applicant's *Fair Share Contributions* at all locations as reflected in the following formula:

$$Fair\ Share\ Congestion\ Mitigation\ Payment = Sum\ of\ all\ Locations'\ Fair\ Share\ Contribution$$

Fair share mitigation payments may not be used to address safety impacts.

VEHICLE MILES TRAVELED (VMT) CONGESTION MITIGATION PAYMENT

At the discretion of the Commission, an applicant may propose to mitigate some or all congestion impacts of a DRI project using a location-based, Vehicle-Miles-Traveled (VMT) Congestion Mitigation approach. The VMT Congestion Mitigation payment analysis varies based on the location of the proposed project. Projects located in a way that minimizes the burden on the existing transportation network will have a lower calculated VMT Congestion Mitigation payment.

Where a Vehicle Miles Traveled (VMT) Congestion Mitigation Payment is proposed by the Applicant and deemed appropriate by the Commission, the Payment should be based on workbooks for calculating VMT Congestion Mitigation payments available on the Cape Cod Commission's website www.capecodcommission.org or another method deemed acceptable by the Commission. This Workbook will be updated by Cape Cod

Commission staff periodically as new cost data and analysis parameters become available.

If the impact area extends beyond the boundaries of the town in which the development is being proposed, the applicant should present an analysis of the relative impacts in each town to allow such funds to be divided between towns based on the development's impact area.

GENERAL APPLICATION REQUIREMENTS (TRANSPORTATION IMPACT ASSESSMENT ELEMENTS)

Applicants are encouraged to reach out to Cape Cod Commission staff early in the application preparation process to discuss application materials necessary to demonstrate that the project meets the applicable goals and objectives. The application materials are generally presented in the form of a Transportation Impact Assessment (TIA). The scope of a TIA is largely informed by the scale of the potential impact to the transportation system as approximated by the anticipated peak hour trips generated by the project. It is recommended that Applicants submit, in the form of a letter to Cape Cod Commission staff, a draft TIA scope, including the identification of the Study Area, prior to formal application submission. Cape Cod Commission staff will respond to such a letter with recommendations on the appropriateness of the proposed scope. TIA scoping recommendations will be determined on a case-by-case basis based on the location, context (as defined by the Placetype of the location), nature, and other characteristics of a project. Typical TIA elements recommended for inclusion based on the scale of the project are presented below.

Transportation Impact Assessment (TIA) Framework	< = 50 Anticipated Peak Hour Trips*	> 50 Anticipated Peak Hour Trips*	> 100 Anticipated Peak Hour Trips*
A. Project description	x	x	x
B. Trip generation analysis	x	x	x
C. Detailed multi-modal site plan	x	x	x
D. Driveway safety analysis	x	x	x
E. Off-site safety analysis**		x	x
F. Trip reduction analysis***			x
G. Off-site congestion analysis			x
Appendices	As needed	As needed	As needed

*Proposed trips minus existing trips (see page 24)

**Required for Study Area locations where the project is expected to increase traffic by 25 or more trips during the project's peak hour. This criterion is typically only met for projects anticipated to generate 50 or more peak hour trip.

***Required if credits for trip reduction measures are proposed.

The TIA elements are described in more detail in the following section.

A. Project Description

1. Locus Map – Provide a map including regional roadways and town boundaries to provide a regional context.
2. Study Area Map – Provide a map identifying all Study Area locations (roadway segments and intersections) to be analyzed in the TIA. Study Area locations should include, at a minimum, all regional road links, all intersections of regional roads, and all local road intersections with regional roads that are used by a project for access to the regional road network, where the project is expected to increase traffic by 25 or more trips during the project's peak hour. Additional Study Area locations, identified in consultation with Cape Cod Commission staff, town officials, and, as appropriate, the Massachusetts Department of Transportation (MassDOT), may be required.
3. Site Access and Context Map – Provide a map showing site access and all properties and their driveways within 500 feet of the project site. This map should also include property lines, roadway layouts, any driveway interconnects to other properties, and the approximate size of nearby developments.
4. Roadway Network – Describe and provide a map of all the Study Area roadways and intersections indicating jurisdictional responsibilities of each roadway link within the study area.
5. Multi-modal Network – Describe and provide a map of all pedestrian, bicycle, and transit accommodations within the Study Area not already detailed in the description of the Roadway Network.
6. Traffic Volumes – Provide a table and map with Existing Conditions Peak Season and Average Season average weekday daily, AM peak hour, and PM peak hour volumes at all Study Area locations. Saturday daily and peak conditions should also be included for retail developments or other high weekend traffic generators.

   The base year of Existing Conditions Analysis is the year in which the project has been referred for DRI review or filed a Development Agreement application. Actual count volumes that are factored to base year levels should be no greater than two (2) calendar years old prior to the base year.

   Non-peak season traffic counts should be adjusted using Seasonal adjustment factors from the most recent edition of the Cape Cod Commission's Traffic

Counting Report for Cape Cod or, as approved by Cape Cod Commission staff, adjustment factors based on local traffic data. Any adjustment factors or growth rates used should be cited and referenced.

B. Trip Generation Analysis

1. Trip Generation – Trip generation calculations should be based on the unadjusted rates for the particular land use code(s) applicable to the project from the most recent edition of the *Trip Generation Manual,* using methodologies described in the *Trip Generation Handbook*, both published by Institute of Transportation Engineers (ITE). Trip generation calculations should be developed using the "fitted curve" equations when statistically appropriate as determined by the methodologies in the Manual and Handbook. Trip generation calculations should be based on square footage in the case of most commercial development and on the number of dwelling units in the case of most residential development. For peak hour analyses, the "Peak of Generator" trip generation should be used.

   A Local Trip Generation Study may be accepted as the nature of the project warrants. Any Local Trip Generation Study should meet, at a minimum, the ITE guidelines for local trip generation studies as detailed in the most recent edition of the ITE Trip Generation Handbook. This includes the provision that data from at least (3) three facilities similar to the project be included in the analysis.

2. Credits for Existing Development – Credits for existing development should be based on the estimated annual average daily and peak-hour trip generation of the immediate prior use on the site based on the standard trip generation approach, a Local Trip Generation Study, or actual counts from the site as determined in consultation with Cape Cod Commission staff. Outside of Community Activity Centers and Industrial Activity Centers credits for existing development shall not be allowed if the previous use has been discontinued or vacated for five or more consecutive years. The difference in trip generation between existing and proposed development on site will serve as the basis for TIA analysis.

3. Multi-Use Developments – In some multi-use developments, land use interactions may reduce overall trip generation. All trip generation reductions suggested by the applicant resulting from multi-use development should be clearly documented, based on the methods outlined in the most recent version of the *ITE Trip Generation Handbook* , or other best practices as may be approved by Commission staff.

4. Heavy Vehicle Traffic – An estimate of heavy vehicle traffic to/from the site under Build conditions should be included as appropriate.

5. Trip Generation Adjustments – The order in which the various adjustments to trip generation are to be computed is as follows:
    a. Unadjusted trip generation (Weekday, AM peak hour of generator, PM peak hour of generator, Saturday, Saturday peak hour of generator, Sunday, Sunday peak hour of generator, as applicable);
    b. Interconnection reduction credit may be applied for DRIs that allow for site traffic to travel conveniently and safely to adjacent properties without traveling on or crossing a public way or that allow for mixed-use development that minimizes dependence on automobile travel. The credit should be a 10-percent reduction apportioned between the two properties or, if greater, a traffic credit as outlined in the latest edition of the Institute of Transportation Engineers Trip Generation Handbook, or another acceptable methodology subject to Commission approval;
    c. Trip reduction credits; and
    d. Pass-by reduction (if applicable) based on the most recent data from ITE.
6. Trip Distribution Analysis – All generated vehicle trips to/from the site through all access points are to be documented, including the following trip types:
    a. Primary – type of trip in which the purpose of the trip is travel exclusively to the proposed development site.
    b. Pass-By – type of trip directly from the traffic stream passing the proposed development site on the adjacent street system, not requiring a diversion from the primary route.

    Certain projects may be eligible to reduce their anticipated trip generation through pass-by trip reductions. The amount of pass-by trips associated with the applicable land uses should be based on the most recent data from ITE.

    Land uses eligible for pass-by trip reductions are:

    - Retail, banks, supermarkets, hardware stores, convenience stores, fast-food and high-turnover restaurants, gas stations, retail building material stores (provided a majority of the business sales are to retail, not wholesale, customers), and pharmacy/drug stores.

    Land uses not eligible for pass-by trip reductions are:

- Residential, medical and dental offices and clinics, hospitals, churches, schools, offices, libraries, industrial, manufacturing, warehousing, self-storage, automotive sales and services, theatres, golf courses and driving ranges, arenas, athletic facilities and fields, gyms, casinos, bowling alleys, recreational facilities, and night clubs.

Notwithstanding the above, Cape Cod Commission staff may make further determinations as to the applicability/eligibility and amount of pass-by trip reductions to particular land uses as the nature of a project warrants, including determinations as to land uses not appearing in the lists above.

7. Trip Generation and Distribution Summary – A graphical or tabular summary of trip distribution and trip generation outlining trips to and from the project site should be submitted.

C. Detailed Multi-modal Site Plan

1. Vehicle, Pedestrian, Bicycle, and Transit Users Accommodation – A narrative description of how site and driveway design will accommodate all potential users including motorists, bicyclists, pedestrians, and other non-motorists should reference plans included in the DRI application materials.
2. Connections to the Regional Systems – A narrative description of how site and driveway design connect to the region's pedestrian and bicyclist network.

D. Driveway Safety Analysis

1. Access Management Discussion– A narrative description of the access management approach employed in site design and how it meets current industry best practices to the greatest extent feasible given any unavoidable site constraints.
2. Sight Distance Analysis – Measurements of available sight distance should be taken at all existing and proposed project site access/egress locations. Sight distance requirements should be determined according to the most recent *A Policy on Geometric Design of Highways and Streets* published by the American Association of State Highway and Transportation Officials (AASHTO).

E. Off-Site Safety Analysis

1. Crash History and Analysis – Provide a table and map with number of crashes occurring at each Study Area location (roadway segment and intersection) over the most recent five (5) years on record with the Massachusetts Registry of Motor Vehicles.

   A collision diagram and crash data summary table should be prepared for these high crash locations based on crash reports obtained from the local police

department and, as appropriate, the Massachusetts State Police.

Crash analysis for all high crash locations should include identification of potential safety issues at the location. Crash analysis should also identify any potential safety impacts attributable to a proposed project as they must be mitigated as required by the RPP. See page 11 of the Technical Bulletin for guidance on mitigating safety impacts.

2. Safety Impacts – Identify the anticipated safety impacts of the proposed development at each Study Area location
3. Safety Mitigation Analysis and Summary – Provide a summary of the safety analysis and proposed safety

F. Trip Reduction Analysis

1. Proposed Trip Reduction Measures – Identify proposed trip reduction measures. See page TR-14 of the Technical Bulletin for discussion on trip reduction methods.
2. Trip Reduction Credit Estimation – The anticipated success of these trip reduction measures should be clearly documented and based on standard industry practice.

G. Off-Site Congestion Analysis

1. Current and Future Traffic Volumes – The Future No-Build and Future Build conditions should be graphically shown for the AM peak hour of generator, PM peak hour of generator, and if applicable, Saturday and Sunday peak hour of generator for the peak season and average season. Future conditions should cover a seven-year time horizon as a minimum. This seven-year horizon should be from the Base Year as previously defined.
    a. A graphical summary should be submitted showing the seven-year Future No-Build traffic volumes. Background baseline traffic growth should be included in future year background volumes. The traffic assignment for all other anticipated developments with the potential to impact Study Area locations should be combined with future year background volumes to develop the Future No-Build traffic volumes. Other anticipated developments are those permitted, licensed or approved; those having applied for permits, licenses or approvals; or those pending permits, licenses or approvals from state agencies, the Commission, and/or municipal governments within, at a minimum, the most recent prior seven-year period.

b. A graphical summary of project-generated trips on regional roadway links and intersections after adjustments should be submitted.

c. The traffic assignment for the project should then be added to the Future No-Build volumes to generate Future Build volumes.

2. Current and Future Conditions Level of Service (LOS) Analysis – Existing Conditions LOS should be computed for the roadway network including site driveways, site access links and intersections (if appropriate), and all regional roadway elements (including roadway links, intersections, U-Turns, rotaries, roundabouts, interchanges, bridges, and the like). LOS analysis should include: delay, volume to capacity (v/c) ratio, queue length, and, as applicable, heavy vehicle percentages, travel time, weave, merge, and diverge analyses. These analyses should be performed using the most recent Highway Capacity Manual and any updates published by the Transportation Research Board. Computer software programs used for LOS analysis should be approved in the most recent version of *A Guide on Traffic Analysis Tools* published by the Massachusetts Department of Transportation, or superseding publication. Software printouts for any traffic analysis results referenced should be provided and should include assumptions, inputs, and results.

   LOS analysis should be provided for both Peak Season conditions as well as Average Season conditions. The Cape Cod Commission may also request examining a specific peak hour depending on the type of development and location. Generally, it is the hour during which the development has the greatest number of trips in and out (also called the "Peak of Generator") which should be analyzed. Performance indicators such as volume to capacity ratio (v/c ratio) and delay should be reported regardless of value (e.g., v/c ratios greater than as well as less than 1.0, and seconds of delay greater than as well as less than 80 should be presented).

   LOS should be computed under Future No-Build and Build conditions, without and with proposed mitigation measures in place, for the peak and average season. LOS analysis should include: delay, volume to capacity (v/c) ratio, queue length, and, as applicable, heavy vehicle use percentages, travel time, weave, merge, and diverge analyses. The analysis should cover all regional roadway elements, site driveway intersections, and any intervening roadways between the development and the regional roadway access.

3. Congestion Mitigation Analysis and Summary –
    a. Mitigation Actions – These should be clearly identified along with the anticipated future year performance under Future Build conditions, as evidenced by performance indicators such as delay, v/c ratios, and queue lengths. Mitigation improvements should address safety-related impacts at high crash locations as identified during the DRI review process.
    b. Mitigation Analysis – Analyses of all mitigation measures should be computed as outlined on page 17 to page 19. A roundabout analysis should be conducted at any intersection where a new traffic signal is proposed. Impacts on wetlands, archaeological resources, right-of-way availability, historic resources, scenic resources, community character, or other issue areas in the RPP should be identified and quantified.
    c. Proposed Mitigation – The analysis should clearly identify the total cost and timing of the proposed mitigation improvements, including costs and timing associated with any specific phase or part thereof. Cape Cod Commission staff should be consulted to develop an estimate of operations and maintenance costs for signals that will be given over to town jurisdiction. Cape Cod Commission staff should be consulted to develop estimates of costs for the purchase, installation, operations, and maintenance of automated traffic counting equipment. Conceptual improvement plans should be developed showing the recommended proposed improvements. The proposed improvements should be clearly shown in relation to the existing right-of-way, including:
        i. Scaled plan showing existing and proposed right-of-way layout lines;
        ii. Proposed roadway geometric changes and widening (storage lanes, acceleration/deceleration lanes); and
        iii. Proposed intersection improvements, signalization, and/or signal improvements including conceptual phasing and timing.
    d. Mitigation Payments – Congestion Mitigation methodology using a Fair Share or Vehicle Miles Traveled Congestion mitigation approach are detailed on page 19 and page 20, respectively.

Appendices

1. Recorded Traffic Counts
    a. Turning movement counts, including heavy vehicles
    b. Directional volume counts

   c. Existing AM/PM peak period and 24-hour traffic volumes including Peak Hour Factors by approach
   d. Future year peak hour traffic volumes
   e. Adjustment factors and sources
2. Crash Analysis Supplements
   a. Tabular crash data for all study area intersections
   b. Collision diagram and crash data summary for all high crash locations (if not included elsewhere in the TIA)
   c. Supplemental analysis or references to support the effectiveness of proposed safety mitigation countermeasures as appropriate
3. LOS Analysis Data
   a. Lane geometry
   b. Assumed signal phasing and timing
   c. Assumed saturation flow rates
   d. All worksheets or computer outputs
4. ITE Land Use Code Sheets – or other summary sheets showing trip generation calculations
5. ITE Multi-use Development, or other approved Trip Reduction Estimate Sheets
6. Signal Warrant Analysis Sheets

REFERENCES AND RESOURCES

References

1. American Association of State Highway and Transportation Officials (AASHTO). *A Policy on Geometric Design of Highways and Streets*. Most recent edition.
2. Cape Cod Commission. *Cape Cod Regional Policy Plan*. Most recent edition.
3. Cape Cod Commission. *Complete Streets/Living Streets: A Design Manual for Cape Cod*. Most recent edition.
4. Cape Cod Commission. *Traffic Counting Report for Cape Cod*. Most recent edition.
5. Federal Highway Administration. *Manual on Uniform Traffic Control Devices Handbook* (MUTCD including the Massachusetts Amendments). Most recent edition.
6. Institute of Transportation Engineers (ITE). *Parking Generation*. Most recent edition.
7. Institute of Transportation Engineers (ITE). *Trip Generation*. Most recent edition.
8. Institute of Transportation Engineers (ITE). *Trip Generation Handbook*. Most recent edition.
9. Massachusetts Department of Transportation (MassDOT, formerly Massachusetts Highway Department) *Massachusetts Highway Department Project Development & Design Guide*. Most recent edition or superseding publication.
10. National Association of City Transportation Officials (NACTO). *Urban Street Deign Guide*. Most recent edition.
11. Transportation Research Board (TRB), National Academies of Sciences, Engineering, and Medicine. *Access Management Manual*. Most recent edition
12. Transportation Research Board (TRB), National Academies of Sciences, Engineering, and Medicine. *Highway Capacity Manual*. Most recent edition.

Mapping Resources

1. Regional Policy Plan Data Viewer
2. Massachusetts Department of Transportation (MassDOT) Crash Portal available at: https://services.massdot.state.ma.us/crashportal/CrashMapPage.aspx
3. MassDOT Roadway Functional Classification Map available at: http://gis.massdot.state.ma.us/maptemplate/roadinventory/